REMARKS

Applicant acknowledges with thanks the examiner's indication that claims 30-32 would be allowable if re-written in independent form to include all the limitations of the base and intervening claims.

Applicant amended independent claim 9 to recite the feature of estimating a further subsequent deformable model for a further subsequent frame of the digital image sequence based on the subsequent deformable model and the computed transformation parameters. Support for this feature is provided throughout the application including, for example, at page 4, line 30 to page 5, line 14, and page 12, line 19 to page 13, line 4. Applicant similarly amended independent claims 1, 18 and 27.

The examiner rejected claims 1-29 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,879,709 to Tian et al.

Specifically, with respect to independent claim 9, the examiner stated:

> Regarding claim 9, Tian teaches a method comprising:
> Determine a deformable model (column 11, lines 23-25) including eye positions and mouth positions (column 11, lines 20-25) for a frame of a digital image sequence (column 12, lines 10-12); and
> Estimating a subsequent deformable model include eye positions and mouth positions (estimates characteristic facial features points in each detected face would include mouth and eye positions) (column 8, lines 5-10) for a subsequent frame of the digital image sequence (column 9, lines 44-48 and column 10, lines 30-35) and
> Computing transformation parameters (compute the location of the **salient** landmarks/points) (column 12, lines 18-25) that represent a transformation from the deformable model (variability/change of shape properties of pose/expression model) (column 9, line 65 to column 10, line 14) for the frame to the subsequent deformable model of the subsequent frame (column 9, lines 44-48 and column 10, lines 30-35). (Emphasis in the original, Final Action, page 5)

Applicant's independent claim 9 recites "... estimating a subsequent deformable model ... for a subsequent frame ... computing transformation parameters that represent a transformation from the deformable model for the frame to the subsequent deformable model of the subsequent frame; and estimating a further subsequent deformable model, ... for a further

subsequent frame ... based on the subsequent deformable model and the computed transformation parameters."

As explained in the specification of the above-identified application:

> **The initial estimates determine an estimate on the previous frame template and the subsequent estimates determine a deformed, current, template. As the next video frame arrives the current template is used as an initial estimation of a new template and subsequent estimates are determined on the new current video frame, thus saving significant processing time and resources that are expanded in determining the parameters representing the initial base face model 200.** [1]

Tian, on the other hand, describes:

> **FIG. 4 is a block diagram of the novel neutral face detection system. It shows the image/video acquisition device (camera) 410 with lens 420 (possibly a zoom, pan and tilt lens) which is used for imaging the objects such as human bodies or body parts 100, 105, 115, 240, 250 and 260. The image/video, acquired by acquisition device 410 is digitized into a fixed number of pixels, each quantized into a fixed number color intensity values by a frame grabber. This is the case if image acquisition device 410 is analog. If the camera is digital, the image/video is directly input into face detector system 430 through USB or firewire. This face detector system 430 determines if there are one or more faces in the image. If there are faces in the image, the characteristic point detector 440 localizes a number of prior art characteristic points. System 440 further establishes a local coordinate system for each face image detected by face detector 430. The image area around each set of characteristic points, for each face characterized by a local coordinate system is then analyzed by facial feature analyzer 450. This system 450 computes one or more facial features and based on the features, classifier 460 determines if the corresponding face depicts a neutral face 470 or a non-neutral face 480. (emphasis added, col. 11, lines 39-65)**

Thus, while Tian's system computes facial features in a face image, Tian's system neither describes nor suggests estimating a model (e.g., a deformable model) of a subsequent frame of a digital image sequence based on, for example, the computed features and/or a previously determined model.

With respect to the prior art face characteristic point detector alluded to by the examiner, Tian explains:

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[1] Applicant's specification (page 5, lines 6-14).

> **Continuing with FIG. 5B where is shown a prior art face characteristic point (landmark) detector. This is a computer system 555 that takes as input 550, which is the output (540 and 545) of the face detector system described in FIG. 5A. When there is a face present in image/video 510, which is indicated to system 555 by a non NIL value of input 550, a prior art characteristic point detector 560 computes the locations of salient landmarks (points). These points are output 565 as a list of image locations and are expressed in terms of image/frame 569 coordinates. The characteristic points include as a first set the inner point of the right eyebrow P_1 570 and the inner point of the left eyebrow P_2 575. As a second set of characteristic points, we have the center of the pupil of the right eye P_3 580 and the center of the pupil of the left eye P_4 585. A final set is the right corner of the mouth P_5 590 and the left corner of the mouth P_6 595. (Here left and right is defined with respect to the person whose face is imaged.)**
>
> **Further, a window 599 is selected such that it encloses the face image with certain tolerances. This window 599 is associated with a face coordinate system x, y 501.** [2]

Thus, the prior art detector described by Tian computes positions of points on face images. However, the prior art face detector does not estimate a model (e.g., a deformable model) based on, for example, those computed positions of the points and/or a previously determined model.

Accordingly, Tian fails to disclose or suggest at least the features of "estimating a further subsequent deformable model, including eye positions and mouth positions, for a further subsequent frame of the digital image sequence based on the subsequent deformable model and the computed transformation parameters," as required by applicant's independent claim 9. Independent claim 9, and the claims depending from it, are therefore patentable over the cited art.

Independent claims 1, 18 and 27 recite "estimate a further subsequent deformable model, including eye positions and mouth positions, for a further subsequent frame of the digital image sequence based on the subsequent deformable model and the computed transformation parameters," or similar language. For reasons similar to those provided with respect to independent claim 9, at least these features are not discloses by the cited art. Applicant's

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[2] Id. (FIG. 5B, and col. 12, lines 18-39)

independent claims 1, 18 and 27, and the respective claims depending from them, are therefore patentable over the cited art.

Additionally, as noted, the examiner rejected claim 10, which depends from independent claim 9, as being obvious over Tian. Specifically, the examiner stated:

> Referring to claim 10, Tian teaches the method wherein computing the transformation parameters (compute the location of the **salient** landmark/points) (column 12, lines 18-25) includes determining optimal values for the transformation parameters such that the value of an objective function based on the transformation parameters is minimized (eliminates complicated degree of freedom/normalization) (column 10, lines 10-14 and column 12, lines 40-55). (emphasis in the original, Final Action, page 6)

Further, in response to applicant's Reply to Final Action of June 28, 2007, the examiner stated:

> Regarding claim 10, the Applicant argues (page 12 of the Remarks) that Tian fails to disclose a function that is minimized to determine optical values for transformation parameters. Again, the Examiner disagrees. As explained in the Final Office Action page 6, lines 1-5, the Examiner has interpreted this as a concept of eliminating degree of freedom to further detect appropriate action of a face (column 10, lines 1-14 and column 12, lines 40-55). Similarly, claim 19 is rejected based on similar reasoning of claim 10 .

Applicant respectfully disagrees with the examiner's contentions regarding claims 10 and 19.

Claim 10 recites "wherein computing the transformation parameters includes determining optimal values for the transformation parameters such that the value of an objective function based on the transformation parameters is minimized." Thus, transformation parameter values associated with a particular objective function at its minimal value are deemed to be the optimal transformation parameters.

In contrast, Tian explains:

> **Face recognition systems work best when both the enrolled face and the face to be authenticated have no expression. The ability to detect if a face image has no expression has, in general, many applications since it eliminates one complicated degree of freedom, the facial expression, from the face image acquisition process. (Col. 10, lines 8-14)**

Tian merely describes that by determining whether a face represented in an image has a neutral or non-neutral expression enables easier face recognition, presumably because there will be fewer facial variations that would have to be considered (e.g., compared) to perform face recognition. Eliminating a degree of freedom is not the same as minimizing an objective function (i.e., finding the minimal value, and its corresponding transformation parameter values, for some objective function).

Tian also describes:

> **FIG. 6 explains how the outputs of the face detector and the characteristic point detector are used to normalize the face image to a fixed resolution and how the zones in the normalized face image are determined. Image 600 is the input image or a frame of the input video (i.e., an image 510). The input image 600 contains the appearance of a human face (face image) 605. Furthermore, it contains a smaller image or window 599 that encloses within specified tolerances the visual appearance of the human face. The window is associated with coordinate system 501. This window is selected in such a way that the important features for face expression are containing therein. We refer in the rest of this invention description to this window as the face image or face appearance image. (This face image can be at the original resolution of input image 600 or it can be at the resolution of image 620 after re-sampling, or normalization, of transform 615.) (Emphasis added, col. 12, lines 40-56)**

In this passage Tian explains that a smaller window, selected in such a way that the window would contain important features for face expression, is used. This passage says nothing about minimizing an objective function, and certainly does not describe minimizing an objective function to determine the optimal transformation parameters.

Thus, contrary to the examiner's contentions, Tian does not describe an objective function that is minimized to determine optimal values for transformation parameters. Accordingly, Tian also fails to disclose or suggest at least the features of "wherein computing the transformation parameters includes determining optimal values for the transformation parameters such that the value of an objective function based on the transformation parameters is minimized," as required by applicant's claim 10. Applicant's claim 10, and the claims that depend from it, are therefore patentable over the cited art.

Applicant's claim 19 (depending from independent claim 18) recites "wherein the instructions that cause the data processing apparatus to compute the transformation parameters

include instructions to determine optimal values for the transformation parameters such that the value of an objective function based on the transformation parameters is minimized." For reasons similar to those provided with respect to claim 10, at least this feature is not discloses by the cited art. Applicant's claim 19, and the claims depending from it, are therefore patentable over the cited art.

It is believed that all the rejections and/or objections raised by the examiner have been addressed.

In view of the foregoing, applicant respectfully submits that the application is in condition for allowance and such action is respectfully requested at the examiner's earliest convenience.

All of the dependent claims are patentable for at least the reasons for which the claims on which they depend are patentable.

Canceled claims, if any, have been canceled without prejudice or disclaimer.

Any circumstance in which the applicant has (a) addressed certain comments of the examiner does not mean that the applicant concedes other comments of the examiner, (b) made arguments for the patentability of some claims does not mean that there are not other good reasons for patentability of those claims and other claims, or (c) amended or canceled a claim does not mean that the applicant concedes any of the examiner's positions with respect to that claim or other claims.

Enclosed is a Request for Continued Examination and a Petition for One Month Extension of Time. The fees in the amount of $810 and $120 are being paid concurrently on the Electronic Filing System (EFS) by way of Deposit Account authorization.

Please apply any other required fees to deposit account 06-1050, referencing the attorney docket number shown above.

Respectfully submitted,

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